RAIO-0818-61443

August 23, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 185 (eRAI No. 8963) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 185 (eRAI No. 8963)," dated August 18, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 185 (eRAI No.8963)," dated October 17, 2017
3. NuScale Power, LLC Supplemental Response to NRC "Request for Additional Information No. 185 (eRAI No.8963)," dated April 04, 2018

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) supplemental response to the referenced NRC Request for Additional Information (RAI).

The Enclosure to this letter contains NuScale's supplemental response to the following RAI Question from NRC eRAI No. 8963:

- 03.08.05-22

This letter and the enclosed response make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Marty Bryan at 541-452-7172 or at mbryan@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

Distribution: Gregory Cranston, NRC, OWFN-8G9A
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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8963

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8963

Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 8963
Date of RAI Issue: 08/18/2017

NRC Question No.: 03.08.05-22

10 CFR Part 50, Appendix A, General Design Criteria (GDC) 1, 2, 4 and 5 provide the regulatory requirements for the design of the seismic Category I structures. DSRS Section 3.8.5 provides review guidance pertaining to stability of foundations.

FSAR Tier 2, Section 3.8.5.6.3, "Bearing Pressure," page 3.8-72, provides static bearing pressures of 10.1 ksf and 6.42 ksf for the RXB and CRB basemats, respectively. The applicant also provides dynamic bearing pressures of 4.6 ksf and 5.32 ksf for the RXB and CRB basemats, respectively. Furthermore, the applicant refers to Figure 3.8.5-3, "Seismic Base Pressure Contours from SASSI 2010 Analysis," to obtain seismic bearing pressure contour for the RXB basemat. It is not clear to the staff how the applicant determined 4.6 ksf from Figure 3.8.5-3. Therefore, address the following:

a. describe the reason(s) why the dynamic bearing pressures of CRB is larger than the dynamic bearing pressures of RXB.
b. explain how the applicant determined 4.6 ksf from Figure 3.8.5-3 for the dynamic bearing pressures of RXB basemat.
c. address and provide figures of static and seismic basemat pressure contours for the CRB and CRB Tunnel.

NuScale Response:

During a Public Meeting on June 12, 2018, the NRC asked NuScale to submit a supplemental response to RAI 8963 question 03.08.05-22. The NRC requested editorial corrections in the following aspects:

- On page 3.8-118 in FSAR Section 3.8.5.4.1.3 "Analysis of Control Building Basemat," the markups refers to "…X and Y directions," at two locations. Since no axes were depicted in some of the RAI response related figures providing results (e.g.; moments) in the FSAR - therefore, it is difficult to identify global X and Y directions. Please update the figures to show the global coordinate system. Furthermore, for correctness, in the body of the FSAR, "X and Y directions" may read "global X and Y axes."

Response: A description of the coordinate system has been included in the title of the basemat result figures. In addition, "global X and Y axes" has been changed in the body of the FSAR.

- Figures 3.8.5-4, -4a, -5, 5a, -6, -6a, -7, 7a depict Mxx and Myy of RXB and CRB basemat moments, but the applicant did not provide any description of those moments in the markups and in the body of the FSAR. Please describe and refer those figures in relevant sections of the FSAR.

  Response: A description of these moments has been included in the FSAR, and callouts have been added in FSAR Section 3.8.5.4.1.3 for the CRB figures. Callouts for the RXB figures are in FSAR Section 3.8.5.4.1.2.

- On page 3.8-120 in Section 3.8.5.4.1.4 “Control Building Basemat Nonlinear Analysis Model Description,” tunnel area is listed as “466.67 ft^2,” in the FSAR. However, it was calculated and tabulated in Table 3.8.5-9 as “500.6 ft^2.” Please correct the apparent inconsistency or explain reasons for the different tunnel areas.

  Response: The tunnel area in the nonlinear analysis is based on finite element analysis model dimensions, which are measured from the mid-surfaces, so it is slightly smaller than the footprint calculated in the table, which is based on the physical dimensions of the tunnel.

In addition, during the June 12th meeting the NRC asked for additional information on how the total control building design moments are developed specifically:

1. Under “Static Demand:” the applicant describes “Three Moments (MX, MY, MZ) are obtained,,,” Further, the response states that the moments about the z-axis were not used. Please explain the reason for not using the moments about the z-axis.

   Response: For a horizontal slab or foundation, the moment about the z-axis is not used in design because it is an in-plane moment. For a slab or foundation, the moment used in design is only the out-of-plane bending moment, with the twisting moment included for conservatism.

   Additional Information on Static Bending Demand Calculation:

   For the CRB foundation static demands, the nodal reactions at 4 nodes of a solid element are converted into the three moments at the neutral plane of the element by using the following vector cross product formula:

   $$M = \sum_{i=1}^{4} d_i \times F_i$$

where:

d_i is the position vector (dx, dy, dz) from the neutral plane (element face center) to node i

F_i is the three component nodal forces (FX, FY, FZ) at node i

M is the moment (MX, MY, MZ) at the center of an element face where the moments are assessed.

Depending upon the face orientation, the twisting moment was added to the out-of-plane bending moments. For example, if the three global directions are as follows:

1. The global X axis is horizontal, pointing toward the east direction.
2. The global Y axis is horizontal, pointing toward the north direction.
3. The global Z axis is vertical, pointing upward.

(a) For an element face perpendicular to the global X axis, the moments are:

- MX is an out-of-plane twisting moment about the X axis
- MY is an out-of-plane bending moment about the Y axis
- MZ is an in-plane moment about the Z axis. This in-plane bending moment should be negligible, if not zero.

For the static bending moment calculation, the twisting moment is added to the out-of-plane bending moments. Therefore, the bending moment demand about the horizontal Y axis is:

MY+MX static out-of-plane bending demand about the Y axis

(b) For an element face perpendicular to the global Y axis, the moments are:

- MX is an out-of-plane bending moment about the X axis
- MY is an out-of-plane twisting moment about the Y axis
- MZ is an in-plane moment about the Z axis. This in-plane bending moment should be negligible, if not zero.

For the static bending moment calculation, the twisting moment is added to the out-of-plane bending moments. Therefore, the bending moment demand about the horizontal X axis is:

MX+MY static out-of-plane bending demand about the X axis

2. Under “Seismic Demand:” the applicant is requested to provide additional information (e.g.; figures, discussions) showing how moments M1, M2, and M3 from the simple supported beams between walls (Figure 2-2), and added wall moments (M1 and M2) were determined from moments of Mxx, Myy, Mxy.

Response:

The repetitive use of variables may have caused some confusion. The following is an explanation using different variables.

The SASSI2010 program was used to calculate the seismic responses. However, for solid elements, the SASSI2010 program does not provide the bending moment directly. Instead, it gives the stresses at the centroid of each solid element modeling the CRB foundation. Therefore, the seismic bending moments were obtained indirectly.

For the seismic moment calculation, the CRB foundation shown in Figure 2-1 was divided into three areas:

a. Exterior Perimeter Area - uses the moments directly from the exterior wall shell elements and pilaster beam elements in contact with the basemat.

b. Interior Area - uses a shell element basemat model subjected to seismic soil pressure. Shell elements give the moment directly.

c. Tunnel Area - the moment was calculated by using the moments in the walls and by using soil pressure. The method is described in Section 2.1 below.

Tunnel Foundation Seismic Moment Calculation

The moment is estimated by using a selected strip of the tunnel foundation with known moments at the exterior walls and interior walls. Note that SASSI2010 provides the moments directly in the shell elements, which are used to model all CRB walls.

The moments at the middle of the foundation strip (see Figure 2-2) between two walls are calculated as described below:

Moment Used

- The moments at both ends, M_{wall1} and M_{wall2}, where the walls are located, are obtained from shell elements modeling the walls.

- Moment due to Soil Pressure under Basemat

  The soil pressure is calculated by averaging the SASSI2010 stress component σ_{zz} over the strip of the basemat. The average soil pressure, designated as ω, acts as an upward uniform distributed load on the bottom of the basemat.

  The moment due to the uniform distributed soil pressure, designated as $M_{onewayslab}$ is calculated assuming that the foundation acts like a simply-supported, one-way slab between the walls, as follows:

$$M_{onewayslab} = \omega \times L^2/8$$

The moment in each wall, M_{wall}, is conservatively calculated by taking the larger of the bending moments, M_{xx_wall} and M_{yy_wall}. The twisting moment, M_{xy_wall}, is also added.

$$M_{wall} = MAX\ (M_{xx\_wall}, M_{yy\_wall}) + M_{xy\_wall}$$

Finally, the moment at the middle of the basemat strip, M_{slab}, is calculated by

$$M_{slab} = (M_{wall1} + M_{wall2})/2 + M_{onewayslab}$$

M_{slab} is taken to be the same in the two horizontal directions, i.e.

$$MX = MY = M_{slab}$$

MX and MY are the seismic bending moments about the global X and Y axes, respectively. MX and MY are to be combined with the static MX and MY by the SAP2000 analyses of the standalone and combined SAP2000 model to obtain the total moments for design.

The partial tunnel, showing the walls and foundation, is shown in Figure 2-2. The elevation is truncated to show only two shell elements above the foundation. The shell element numbers are shown. The plan view of the tunnel foundation with shrunken elements is included in Figure 2-2 to show the wall shell elements (seen as short lines). The rectangles are solid elements, with element numbers shown. The strip of the tunnel area of the CRB foundation used for moment calculation is marked by a green rectangle.

The shell element numbers are shown in Figure 2-3, without the interference of solid elements, for easy identification. The shell elements of the lowest elevation are monolithically built into the basemat.

The calculation of moments is shown in Figure 2-4, displaying the image of the spreadsheet used.

The larger moment of the two spans is used as the seismic moment about both horizontal directions, i.e., MX = MY = 357 kip-ft/ft. This moment represents the maximum seismic moment of the tunnel area of the CRB foundation. It is combined with the static moment to obtain the final design moment.

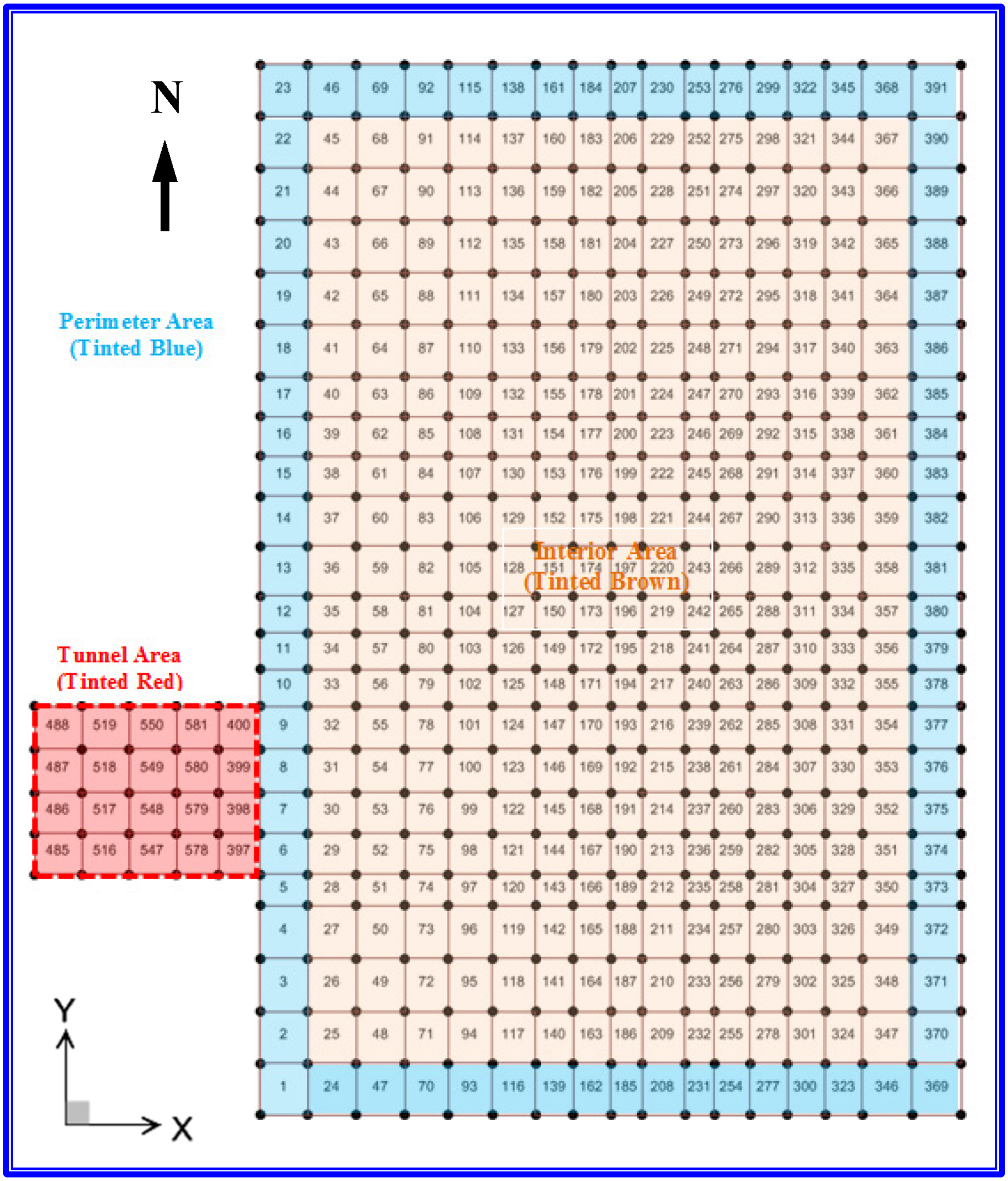


Figure 2-1 CRB Foundation Basemat Plan View

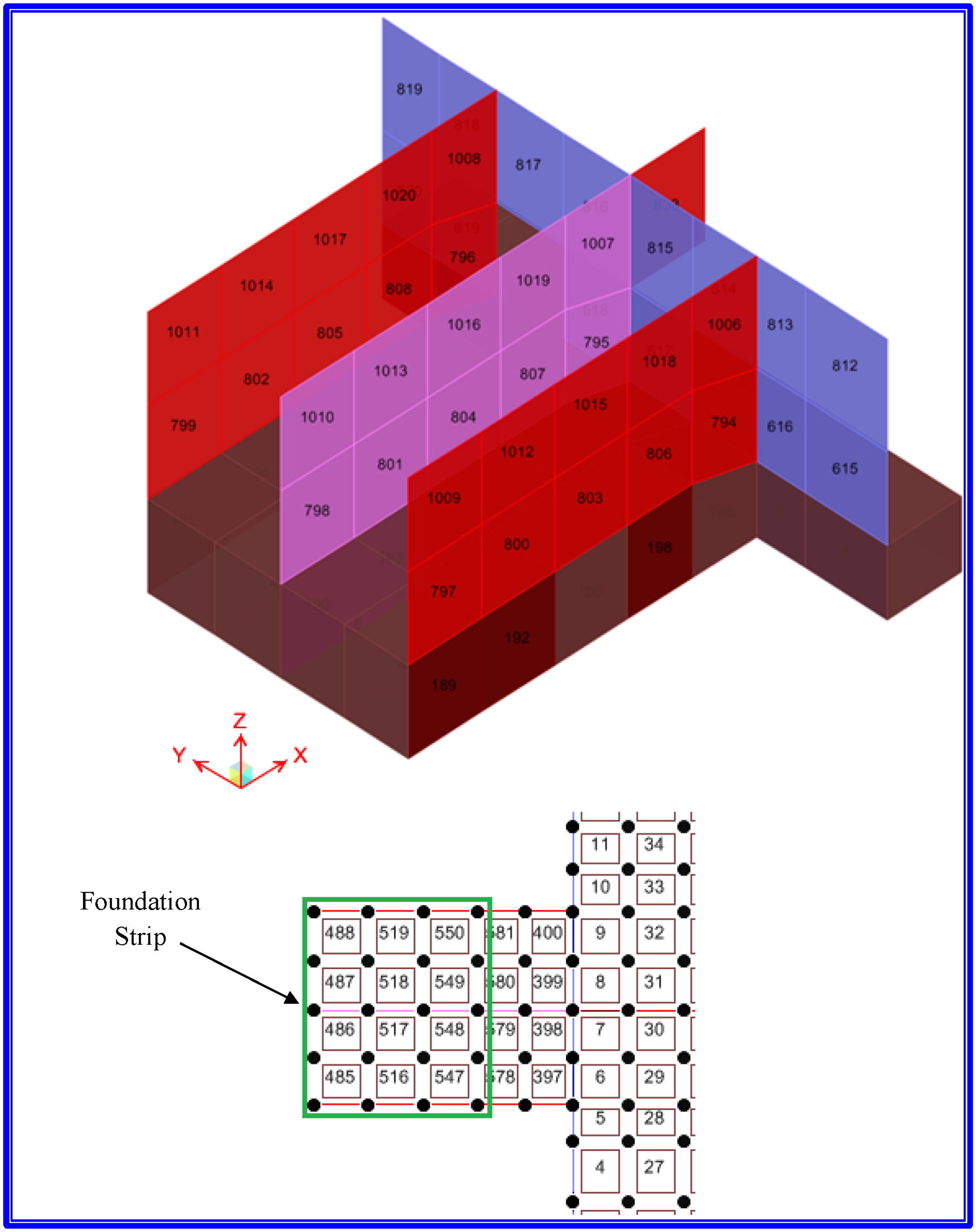


Figure 2-2 Partial Tunnel Showing Foundation and Walls

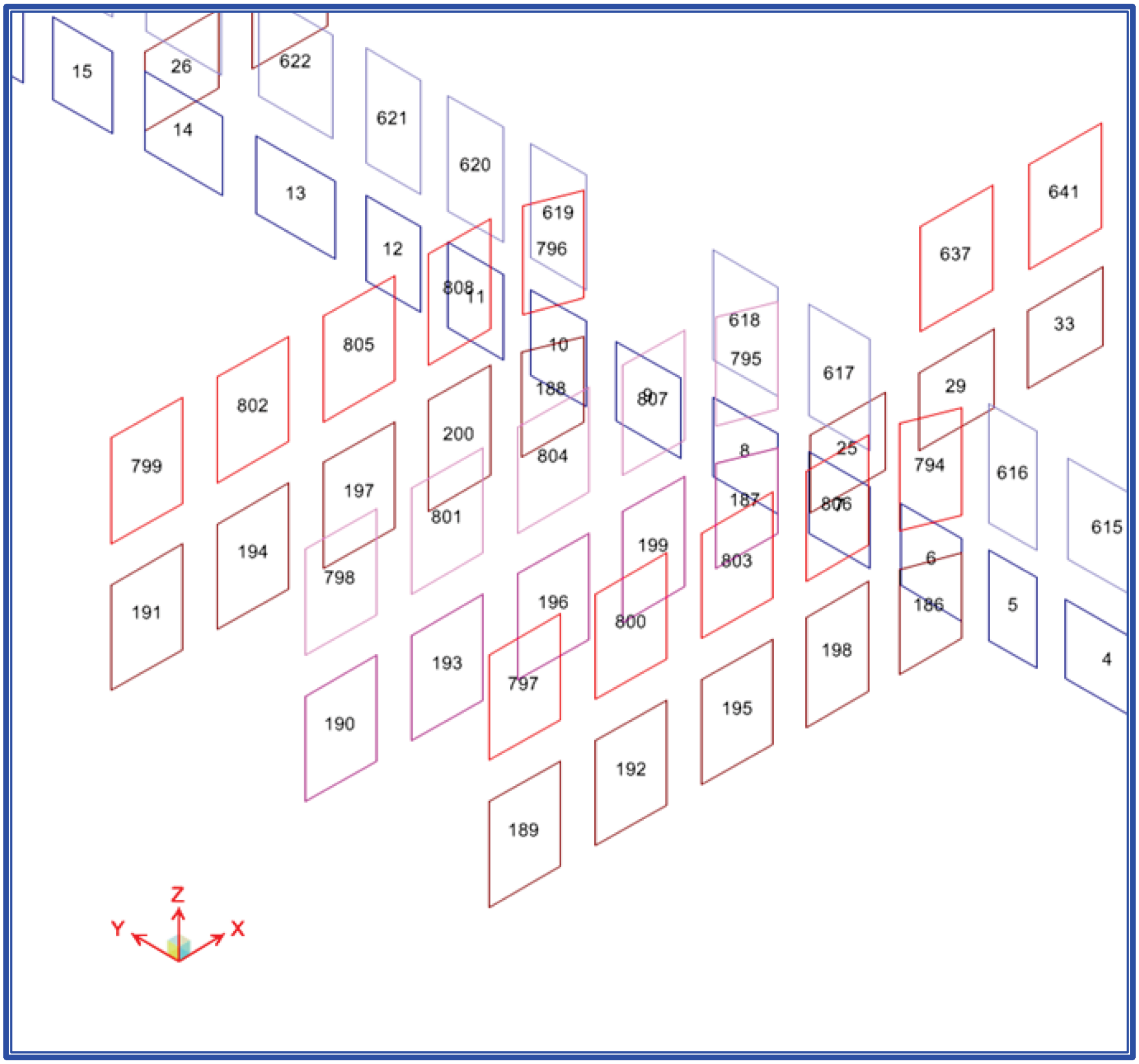


Figure 2-3 Lower Elevation Shell Elements of Tunnel Walls with Element Numbers

	A	B	C	D	E	F	G	H	I
1									
2	NORTH TUNNEL WALL								
3	**Elem.**	**Bending Resultants (lb-in/in)**				**Element**			
4	**No.**	**Mxx**	**Myy**	**Mxy**	**largerM+Mxy**	Length (in)			
5	191CG	100,920.3	21,256.9	25,298.7	126219.010	63		Area=dX*dY	PZ=σzz*Area
6	194CG	100,802.8	23,790.2	20,169.8	120972.587	63	Solid	area	PZ
7	197CG	79,935.9	53,269.5	21,831.3	101767.189	63	Elem.No.	(ft^2)	(kips)
8				Total Moment (lb-in) =	21,984,404	Total (ft)	**485**	23.84375	510.9899051
9				Per Unit Length (kip-ft/ft) =	116.32	15.75	**486**	23.84375	601.0390586
10							**487**	25.15625	539.3646328
11	MIDDLE TUNNEL WALL						**488**	25.15625	394.2622232
12	**Elem.**	**Resultants (lb-in/in)**				**Element**	**516**	23.84375	1105.386059
13	**No.**	**Mxx**	**Myy**	**Mxy**	**largerM+Mxy**	Length (in)	**517**	23.84375	491.4491802
14	190CG	2,392.3	5,012.2	1,818.7	6830.850	63	**518**	25.15625	400.829201
15	193CG	1,700.8	6,559.4	1,495.1	8054.511	63	**519**	25.15625	983.971948
16	196CG	3,070.5	4,789.5	2,055.4	6844.844	63	**547**	23.84375	980.7067674
17				Total Moment (lb-in) =	1,369,003	Total (ft)	**548**	23.84375	422.7000689
18				Per Unit Length (kip-ft/ft) =	7.24	15.75	**549**	25.15625	379.085078
19							**550**	25.15625	761.6097977
20	SOUTH TUNNEL WALL								
21	**Elem.**	**Resultants (lb-in/in)**				**Element**		North Half	South Half
22	**No.**	**Mxx**	**Myy**	**Mxy**	**largerM+Mxy**	Length (in)	pz(ksf) =	25.75304054	25.75304054
23	189CG	43,945.5	122,571.0	54,908.2	177479.155	63	pz(psi) =	178.8405593	178.8405593
24	192CG	38,097.9	95,471.3	20,292.5	115763.744	63	Y Span (ft)	9.583333333	9.083333333
25	195CG	70,200.2	85,859.8	36,129.6	121989.382	63	M of Soil Pressure (kip-ft/ft)	295.65	265.60
26				Total Moment (lb-in) =	26,159,634	Total (ft)	M from Wall Bending Moment (kip-ft/ft)	61.78	72.83
27				Per Unit Length (kip-ft/ft) =	138.41	15.75	**Total Moment (kipf/ft)**	**357.43**	**338.43**
28									

Figure 2-4 Calculation of Moment in Tunnel Walls

3. Please explain why settlement values were not provided for the CRB Tunnel area.

Response: The CRB tunnel settlement has been calculated. The CRB tunnel settlement is provided herein and FSAR Section 3.8.5 has been updated.

The bottom of the CRB foundation and four tunnel foundation bottom corner nodes are shown in Figure 3-1. The protruding tunnel foundation area is on the west side of the CRB.

The elevation view of the CRB with differential settlement calculated using the triple building model is shown in Figure 3-2. The displacements at the four corners of the tunnel foundation calculated for the cracked concrete condition are provided in Table 3-1 and the rotation of the tunnel foundation is -0.0361°, as shown in Table 3-2. The tunnel foundation has negligible differential settlement in the north-south direction, and the differential settlement over 50 ft length in the east-west direction is -0.36".

Table 3-1 CRB Tunnel Foundation Corner Displacements

Node No.	**Displacement (inch)**		
	U1 (EW)	**U2 (NS)**	**U3 (Vertical)**
9590	0.05	0.02	**-2.00**
9594	0.05	0.01	**-2.01**
31071	0.14	0.01	**-1.79**
31075	0.14	0.01	**-1.80**

Table 3-2 CRB Tunnel Differential Settlement over 50 Feet and Tilt Angle

West Settlement (inch)	East Settlement (inch)	Foundation Tilt over 50' (inch)†	Tilt Angle about NS Axis (degree)
-2.00	-1.80	-0.36	-0.0361

† -0.36" = [(-2.00")-(-1.80")]/27.5'×50'; EW Tunnel Foundation Model Width=27.5'

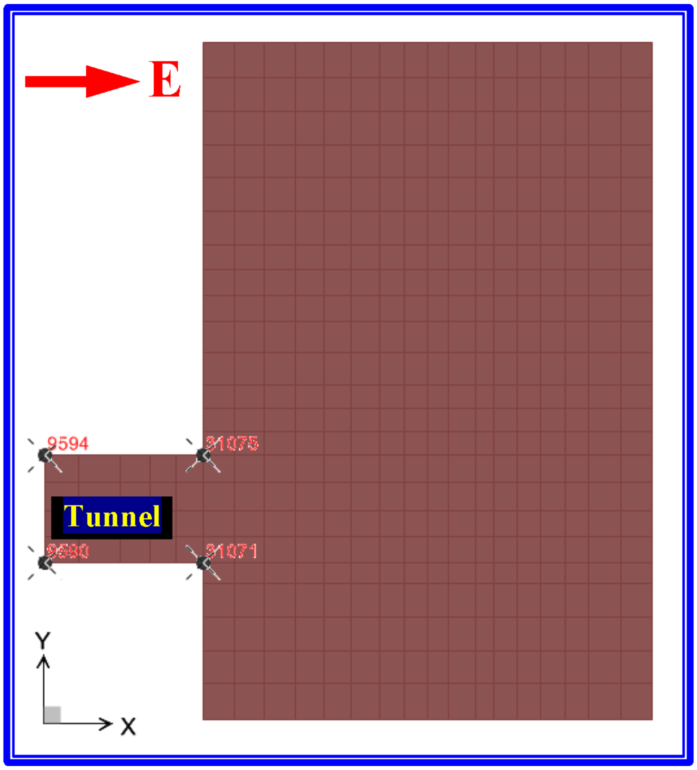


Figure 3-1 CRB Foundation Plan View

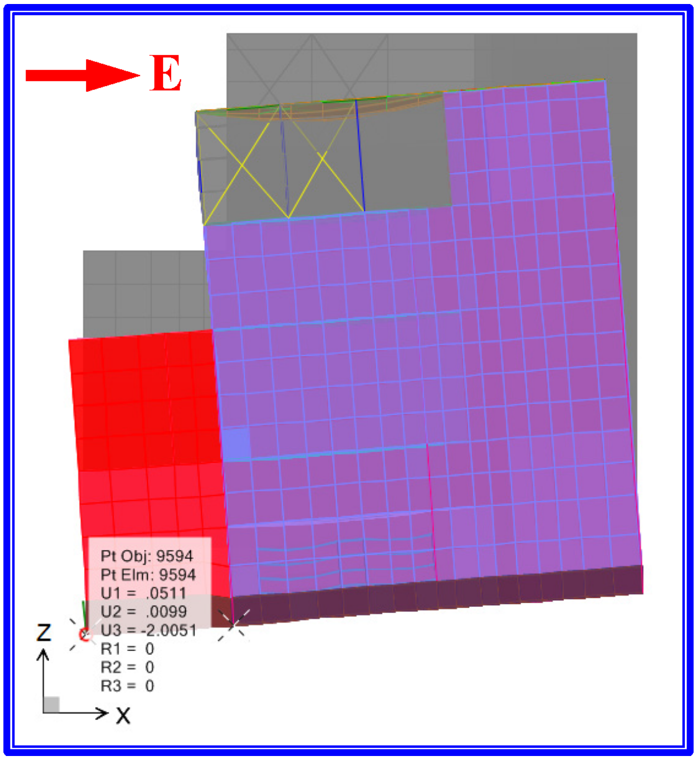


Figure 3-2 Elevation View (Facing North) of Tilted CRB

Impact on DCA:

FSAR Tier 2, Section 3.8.5 has been revised as described in the response above and as shown in the markup provided in this response.

3.8.5.4.1.3 Analysis of Control Building Basemat

RAI 03.08.05-12S1, RAI 03.08.05-22, RAI 03.08.05-22S1, RAI 03.08.05-22S2

The static load results are obtained from the SAP2000 model of the CRB. Both the stand-alone and the combined CRB SAP2000 models are used to obtain the static forces and moments in the basemat, using the most critical static load combination for the calculation of structural responses. Bending moments, axial and shear forces in the basemat are extracted from the SAP2000 CRB global model. To do this, the foundation's solid elements' nodal forces from the CRB model are converted into axial and shear forces, and moments, by applying equilibrium along the solid faces perpendicular to the global X and Y axes. Final bending moments include the effect of the twisting moments.

RAI 03.08.05-12S1, RAI 03.08.05-22S1

For dynamic loads, the basemat solid element stresses obtained from the SASSI analysis are used. The axial and shear forces are obtained by multiplying the axial and shear stresses by the solid element thickness. The bending moments are calculated using a separate SAP2000 shell element basemat model. In this model, the nodes along the base of the concrete walls are fixed and the soil pressure from the SASSI analysis results are applied as out-of-plane pressure to the basemat shell elements. For the shell elements on the perimeter of the basemat, the end moments of the perimeter walls, obtained from SASSI results, are used.

RAI 03.08.05-22S1, RAI 03.08.05-22S2

For the tunnel basemat, the bending moments are also estimated by considering the tunnel basemat as a simple-supported one-way slab spanning between the exterior and middle tunnel walls. Conservatively, the ends moments of the exterior and middle walls are averaged and added to the simple-supported moments at the center of the span. The resultant moment is used for both global X and Y axes.

RAI 03.08.05-10S1, RAI 03.08.05-22, RAI 03.08.05-22S1, RAI 03.08.05-22S2

~~The seismic forces, moments, and stresses in the structural elements, such as walls, beam elements, and basemat, are calculated using the stand-alone and combined SASSI2010 models. The enveloped seismic pressures contours on the CRB basemat are shown in Figure 3.8.5-3a. The enveloped seismic pressures are obtained as a result of the four-step, post-processing method described in Section 3.7.2.4.1. These maximum pressures are loaded into an SAP2000 model of the CRB basemat from where the seismic forces and moments for the basemat design are obtained. Absolute values of the responses obtained by applying base pressures from SASSI2010 are used to arrive at the total seismic demands.~~The solid element seismic stresses are calculated using the stand-alone and combined SASSI2010 models. Figure 3.8.5-2a and Figure 3.8.5-3a show the CRB basemat contour pressure for static and seismic load combinations. Figure 3.8.5-4a and Figure 3.8.5-5a show the CRB basemat static Myy and Mxx from the standalone SAP2000 model. Figure 3.8.5-6a and Figure 3.8.5-7a show the CRB basemat seismic Myy and

Mxx. The enveloped seismic pressures are obtained as a result of the four-step, post-processing method described in Section 3.7.2. Absolute values of the responses are used.

RAI 03.08.05-22

Control Building Basemat and Stability Linear Analysis

Acceptance criteria for flotation/ uplift, sliding, and overturning is based on a factor of safety (FOS) determined from the ratio of the driving force to the resisting force. These analyses are performed statically using the maximum forces from the combinations of soil profiles, time histories, and cracked/ uncracked conditions discussed in Section 3.7. The FOS performed for the CRB yielded unacceptable results (less than 1.1 FOS) for uplift stability; therefore, the uplift, sliding and overturning of the CRB is determined by a nonlinear sliding and uplift analysis.

3.8.5.4.1.4 Control Building Basemat Nonlinear Analysis Model Description

For the nonlinear analysis, the ANSYS CRB model with fixed-base boundary sliding and uplift conditions was changed to:

1) Provide independence of the building and soil domain by establishing coincident joints/nodes for the building and soil in the finite element mesh.

2) Define a nonlinear frictional contact region with the coincident nodes as shown in Figure 3.8.5-26. A coefficient of friction of 0.5 (between the CRB walls and soil) was used so that the tangential force required to overcome the resistance from any compressive normal force is equal to half the normal force, allowing the building to slide and uplift relative to the soil.

3) Obtain, at a typical skin node near the CRB basemat, the seismic input acceleration time histories in the three orthogonal directions for the Soil Type 11 backfill in combination with the surrounding Soil Type 7 and Soil Type 11. Three time histories for each soil type were considered by uniformly applying the time histories from the typical skin node to the CRB and backfill soil nodes, as shown in Figure 3.8.5-27, which are in contact with the in-situ soil. The SASSI time histories for the Capitola input case were selected since that case produced the largest horizontal base reactions, as shown in Table 3.8.5-3. The three time histories are shown in

   - Acceleration time history for each of the Soil Type 11 cases (Figure 3.8.5-28 through Figure 3.8.5-30)
   - Acceleration time history for each of the Soil Type 7 cases. (Figure 3.8.5-31 through Figure 3.8.5-33)

4) Create coincident nodes and define nonlinear node-to-node CONTA178 elements as shown on Figure 3.8.5-34 and Figure 3.8.5-35 to accurately model the contact gap between CRB and soil. The typical definition of CONTA178 elements is shown in Figure 3.8.5-15, where forces are transferred between node-I and node-J only when the gap is closed. The

~~RXB foundation average dynamic pressure is 4.6 ksf. The CRB average foundation dynamic pressure is 2.3 ksf.~~The RXB foundation average dynamic pressure is 4.6 ksf. The CRB average foundation dynamic pressure on the rectangular basemat is 2.3 ksf. The average dynamic pressure on the tunnel area is not calculated. Maximum dynamic pressures across the entire CRB basemat, including the tunnel basemat, are shown on Figure 3.8.5-3a. These pressures are obtained by the post-processing approach indicated in Section 3.7.2.4.1.

3.8.5.6.4 Settlement

RAI 02.03.01-2

Displacement values are provided for selected nodes in the foundation in Table 3.8.5-8. The location of these nodes is shown in Figure 3.8.5-10. As can be seen from the values in Table 3.8.5-8, total settlement at any foundation node, tilt settlement, and differential settlement are minimal. The maximum allowable differential settlement between the RXB and CRB, and between the RXB and RWB is 0.5 inch.

RAI 02.03.01-2

The RXB settles approximately 1¾ inch on the west end and approximately 2 inches on the east end. The tilt settlement of 0.25" is less than 1" as cited in Section 3.8.5.6.1. There is negligible tilt north to south. The east end of the building contains the pool and the NPMs.

RAI 02.03.01-2, RAI 03.08.05-22S2

The CRB settles approximately 1¾ inch on the west end and approximately 1 inch on the east end. The tilt settlement of 0.75" is less than the 1" limit cited in Section 3.8.5.6.2. North to south tilt is negligible. The CRB tilts toward the RXB. Differential settlement between the two buildings is on the order of ¼ inch. The displacements at the four corners of the tunnel foundation calculated for the cracked concrete condition are provided in Table 3.8.5-18, and the rotation of the tunnel foundation is –0.0361°, as shown in Table 3.8.5-19. The tunnel foundation has negligible differential settlement in the north-south direction, and the differential settlement over 50 ft length in the east-west direction is -0.36."

The Seismic Category II Radioactive Waste Building settles approximately ½ inch on the west end and approximately 1½ inch on the east end. The RWB tilts toward the RXB. The RWB tilts approximately 1/5 inch in the north-south direction. Differential settlement between the RWB and the RXB is also on the order of ¼ inch.

3.8.5.6.5 Thermal Loads

During normal operation, a linear temperature gradient across the RXB foundation may develop.

An explicit analysis considering these loads has not been performed, as thermal loads are a minor consideration. Thermal loads are, by nature, self-relieving by means of concrete cracking and moment distribution. This is especially true of the

RAI 03.08.05-22S2

Table 3.8.5-18: CRB Tunnel Foundation Corner Displacements

Node No.	Displacement (inch)		
	U1 (EW)	U2 (NS)	U3 (Vertical)
9590	0.05	0.02	**-2**
9594	0.05	0.01	**-2.01**
31071	0.14	0.01	**-1.79**
31075	0.14	0.01	**-1.8**

RAI 03.08.05-22S2

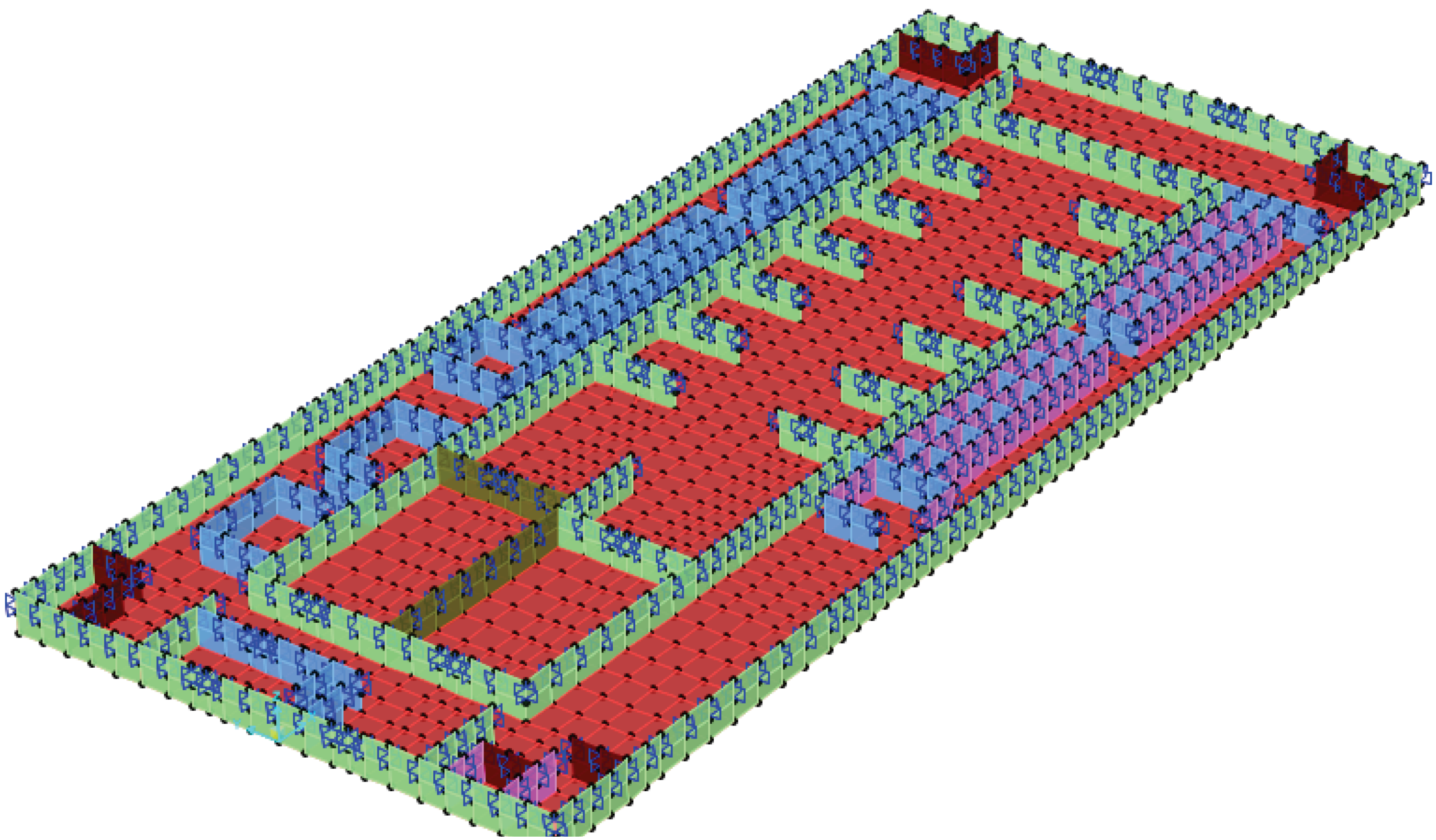
Table 3.8.5-19: CRB Tunnel Differential Settlement over 50 Feet and Tilt Angle

West Settlement (inch)	East Settlement (inch)	Foundation Tilt over 50' (inch)‡	Tilt Angle about NS Axis (degree)
-2	-1.8	-0.36	-0.0361

‡-0.36" = [(-2.00")-(-1.80")]/27.5'×50'; EW Tunnel Foundation Model Width = 27.5'

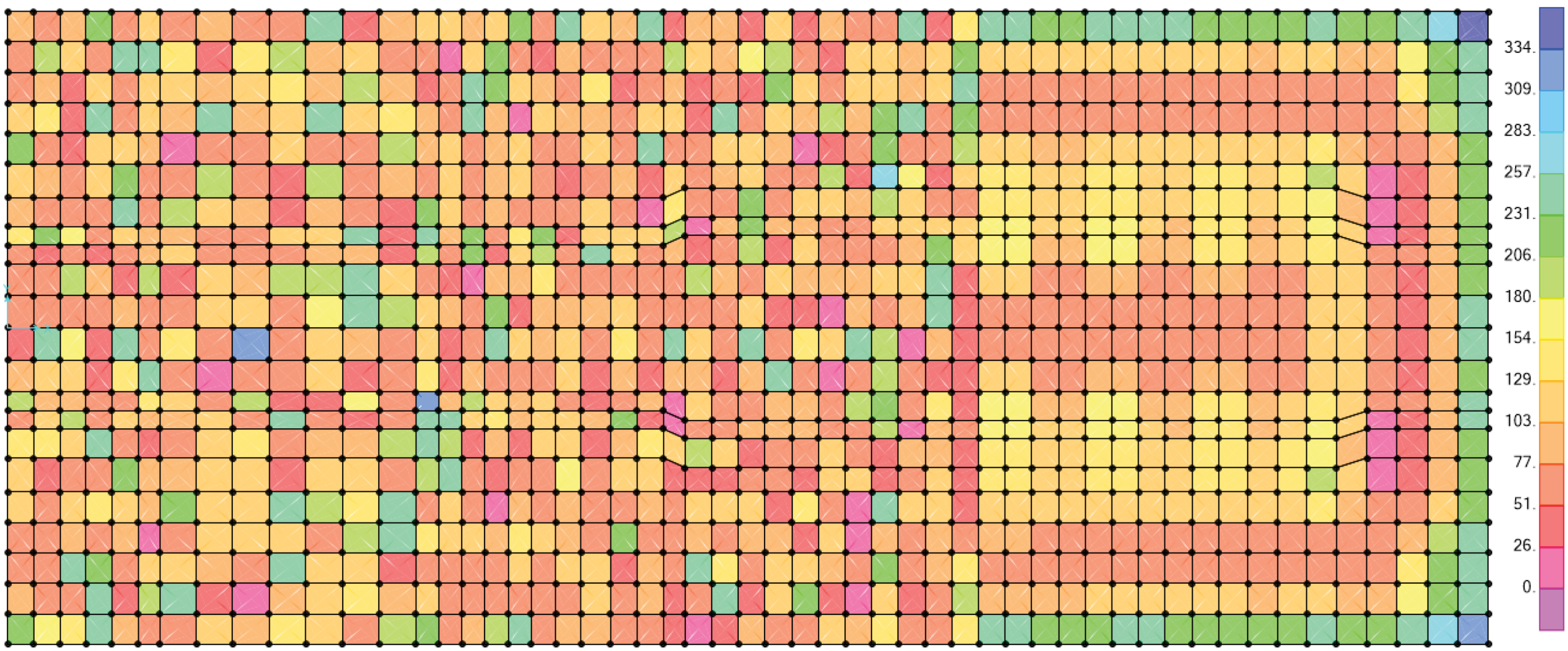
RAI 03.08.05-11S1, RAI 03.08.05-22S2

Figure 3.8.5-1: SAP2000 Model for Evaluation of Design Forces in the Reactor Building Basemat Model (X Axis is in the Longitudinal Direction, Y Axis is in the Transverse Direction, and Z Axis in the Vertical Upward Direction)



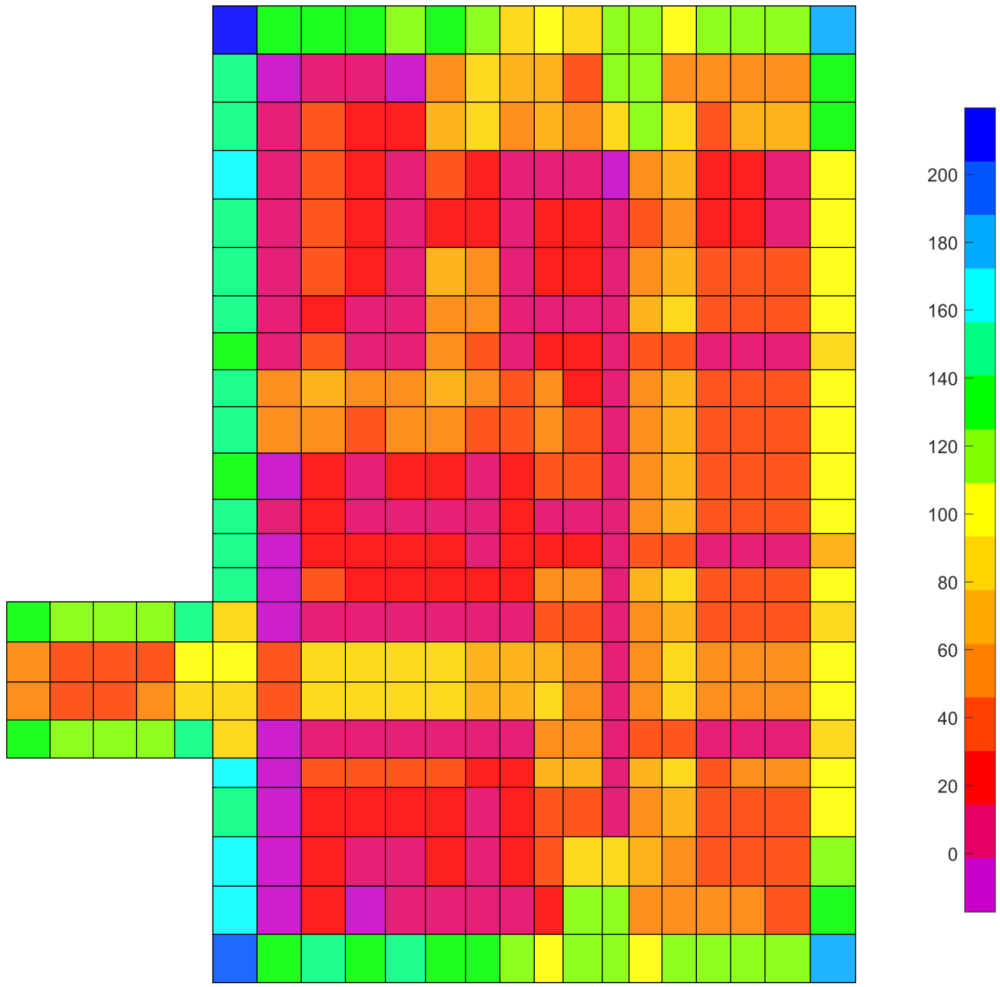
RAI 03.08.05-11S1, RAI 03.08.05-22S1, RAI 03.08.05-22S2

Figure 3.8.5-2: Static Base Pressure Contours for American Concrete Institute Load Combination 9-6 in the Reactor Building Basemat (psi) (Positive X Axis is to the Right of the Image and Positive Y is to the Top of the Image)~~Governing Load Combination in the Reactor Building Basemat Model (Lb, in Units)~~



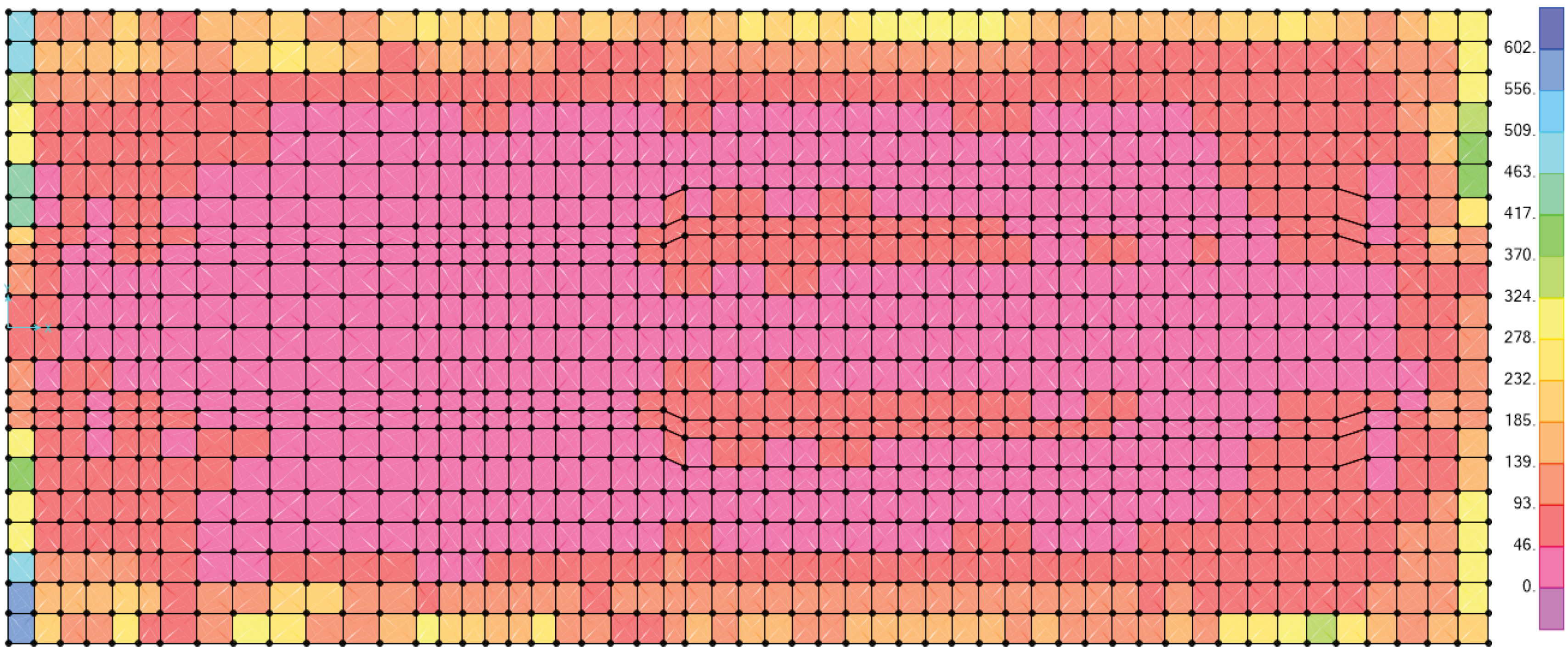
RAI 03.08.05-22S1, RAI 03.08.05-22S2

Figure 3.8.5-2a: Static Base Pressure Contours for American Concrete Institute Load Combination 9-6 in the Control Building Basemat (psi) (Positive X Axis is to the Right of the Image and Positive Y is to the Top of the Image)



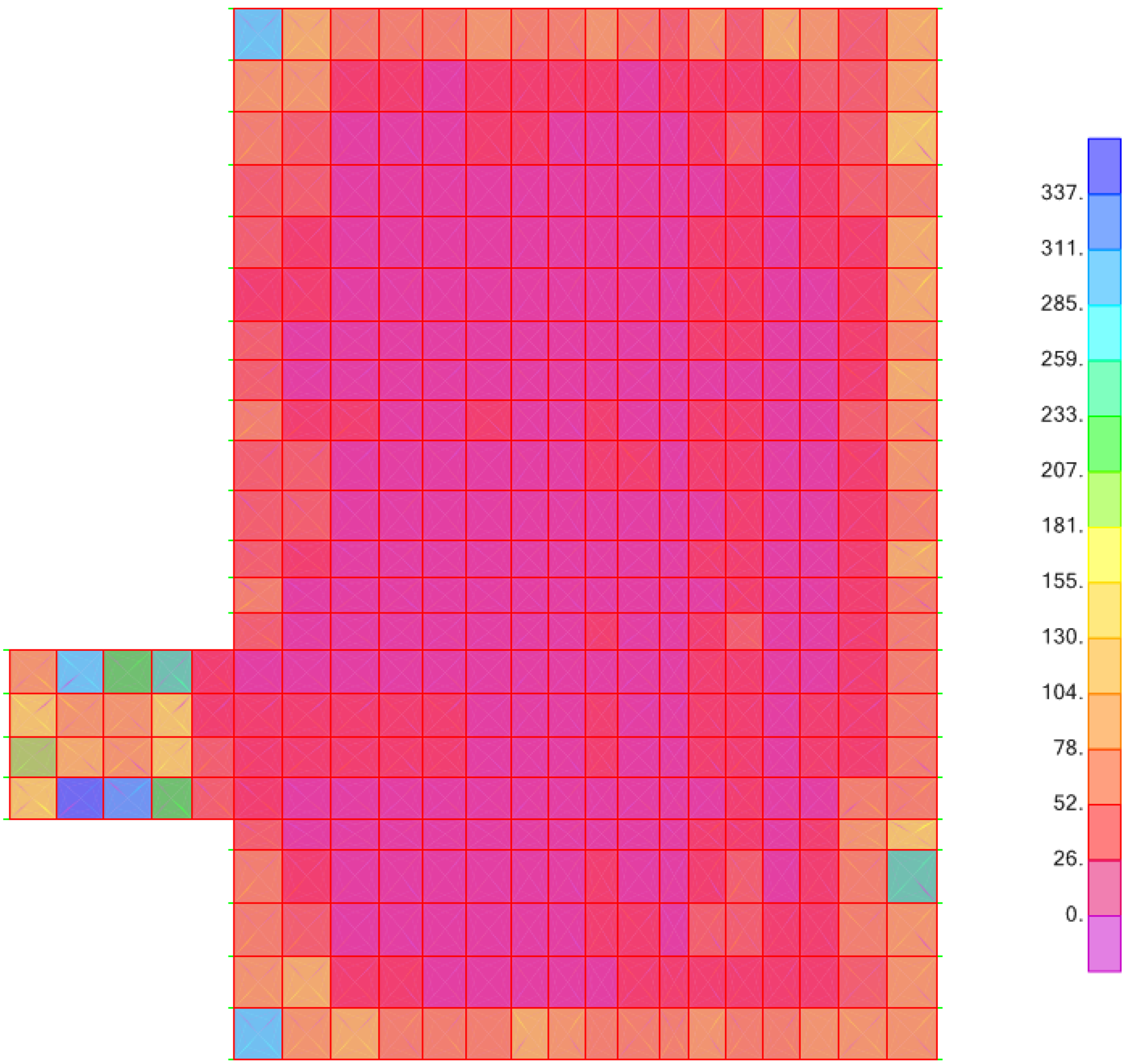
RAI 03.08.05-11S1, RAI 03.08.05-22S1, RAI 03.08.05-22S2

Figure 3.8.5-3: Seismic Base Pressure Contours from SASSI2010 Analysis in the Reactor Building Basemat ~~Model (Lb, inch Units)~~(psi) (Positive X Axis is to the Right of the Image and Positive Y is to the Top of the Image)



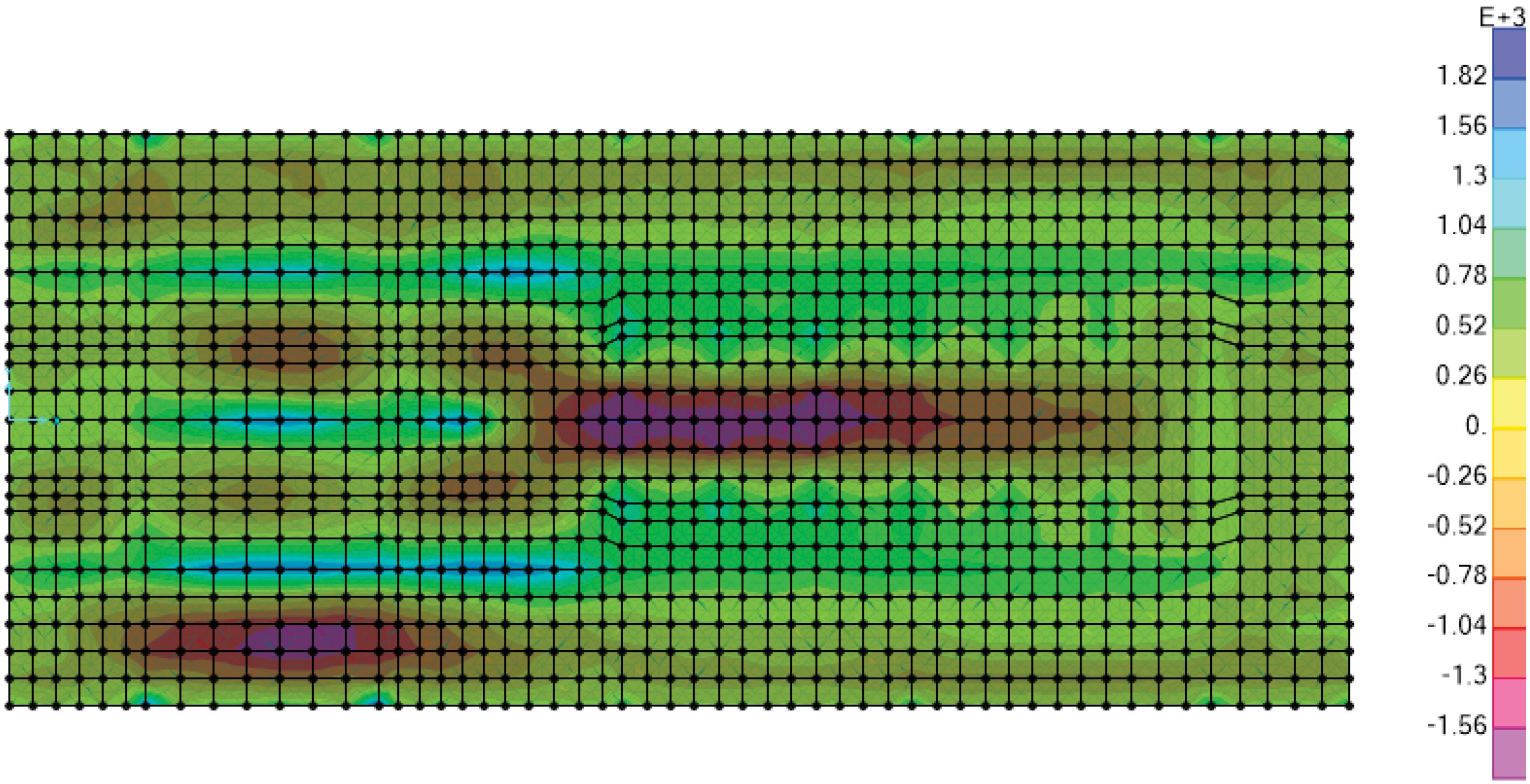
RAI 03.08.05-22, RAI 03.08.05-22S2

Figure 3.8.5-3a: Dynamic Pressure Contours on Control Building Basemat (psi) (Positive X Axis is to the Right of the Image and Positive Y is to the Top of the Image)



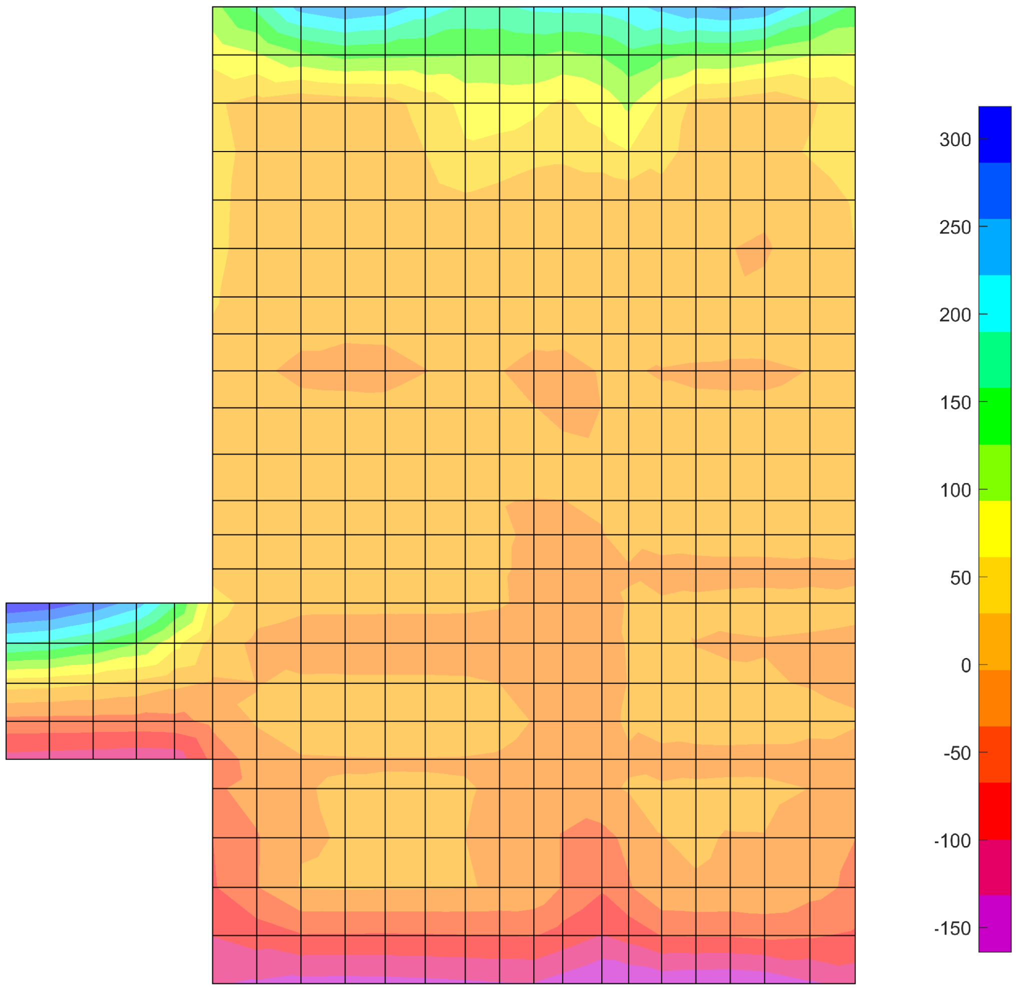
RAI 03.08.05-11S1, RAI 03.08.05-22S1, RAI 03.08.05-22S2

Figure 3.8.5-4: ~~M22 due to Static Base Pressure~~Myy Due to Static Base Pressure on Reactor Building Basemat (kip-ft/ft) in the Reactor Building Basemat Model (Positive X Axis is to the Right of the Image and Positive Y is to the Top of the Image)



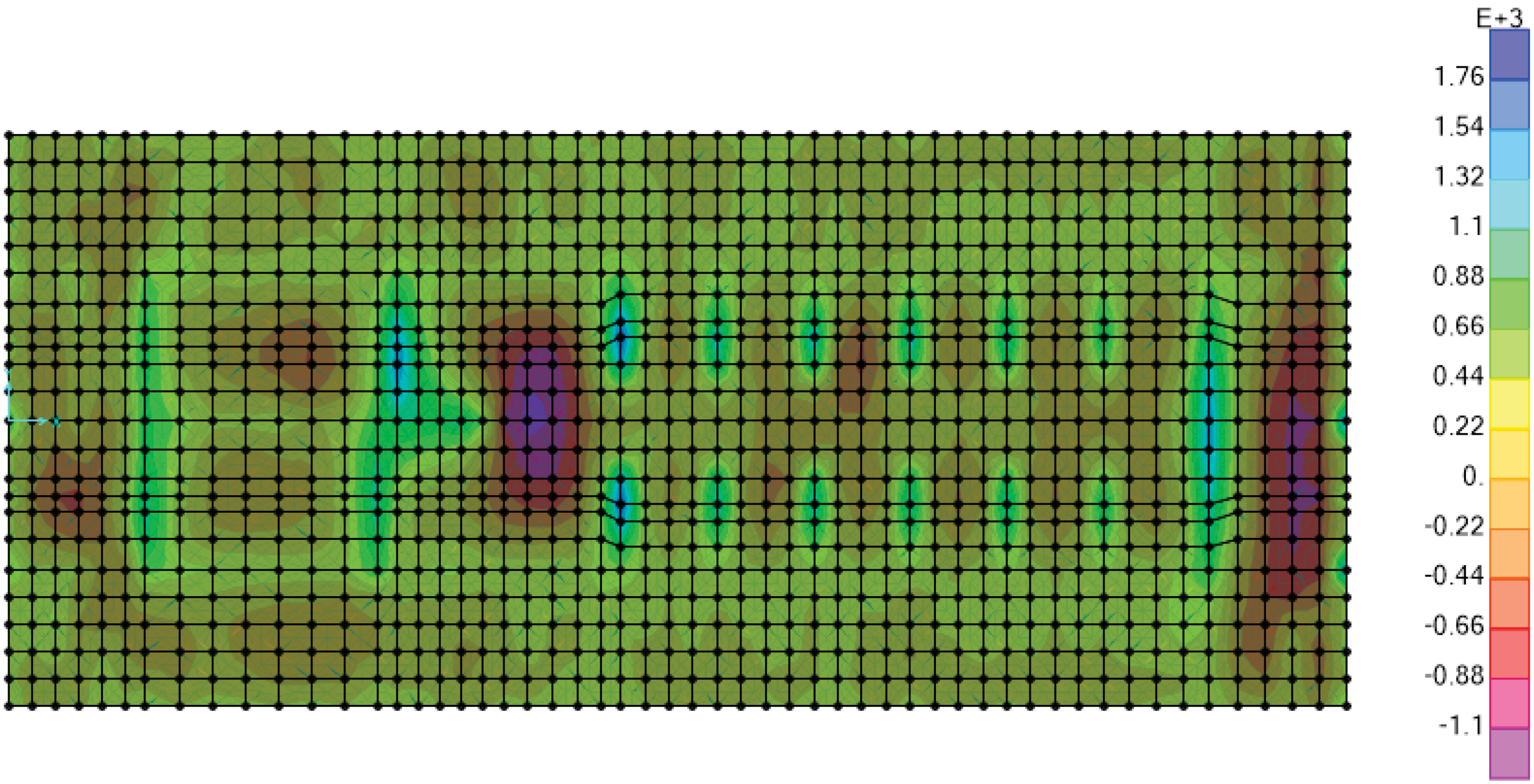
RAI 03.08.05-22S1, RAI 03.08.05-22S2

Figure 3.8.5-4a: Myy Due to Static Loads on Control Building Basemat, Stand-Alone SAP2000 Model (kip-ft/ft) (Positive X Axis is to the Right of the Image and Positive Y is to the Top of the Image)



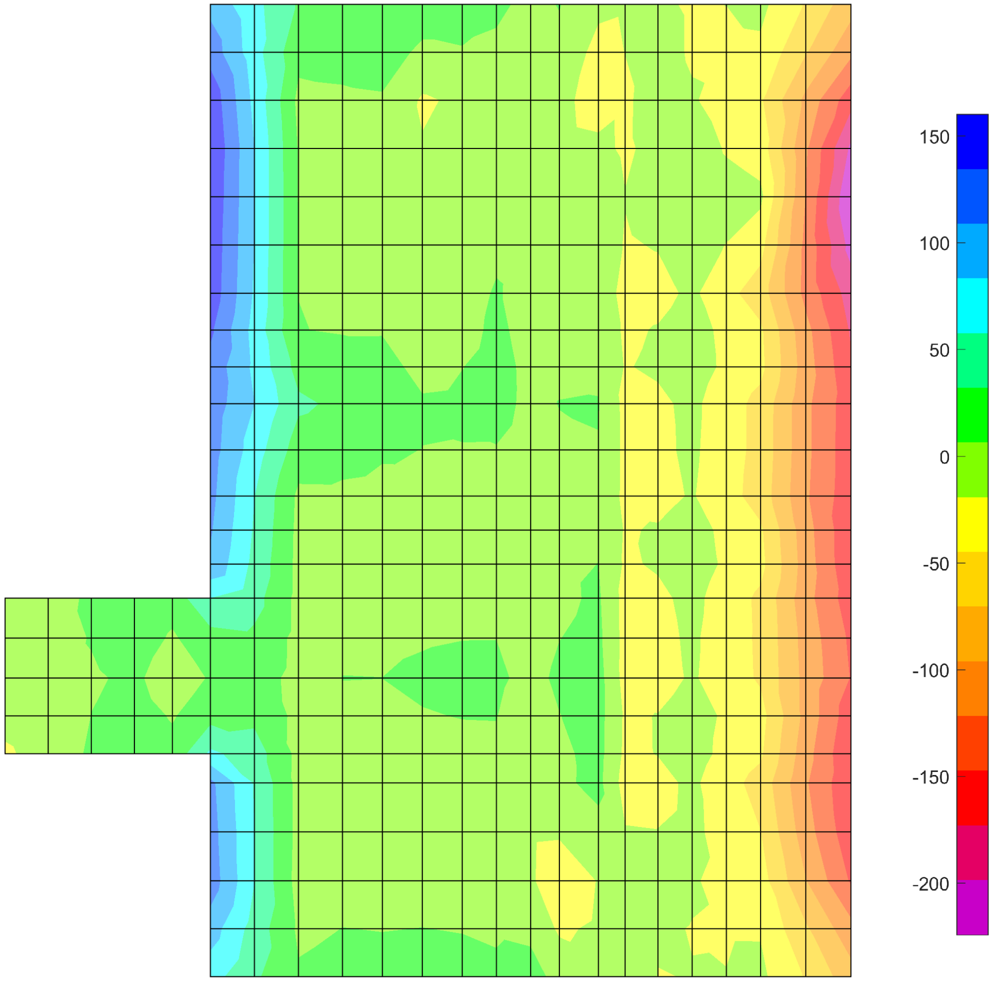
RAI 03.08.05-11S1, RAI 03.08.05-22S1, RAI 03.08.05-22S2

Figure 3.8.5-5: ~~M11 due to Static Base Pressure~~Mxx Due to Static Base Pressure on Reactor Building Basemat (kip-ft/ft) in the Reactor Building Basemat Model (Positive X Axis is to the Right of the Image and Positive Y is to the Top of the Image)



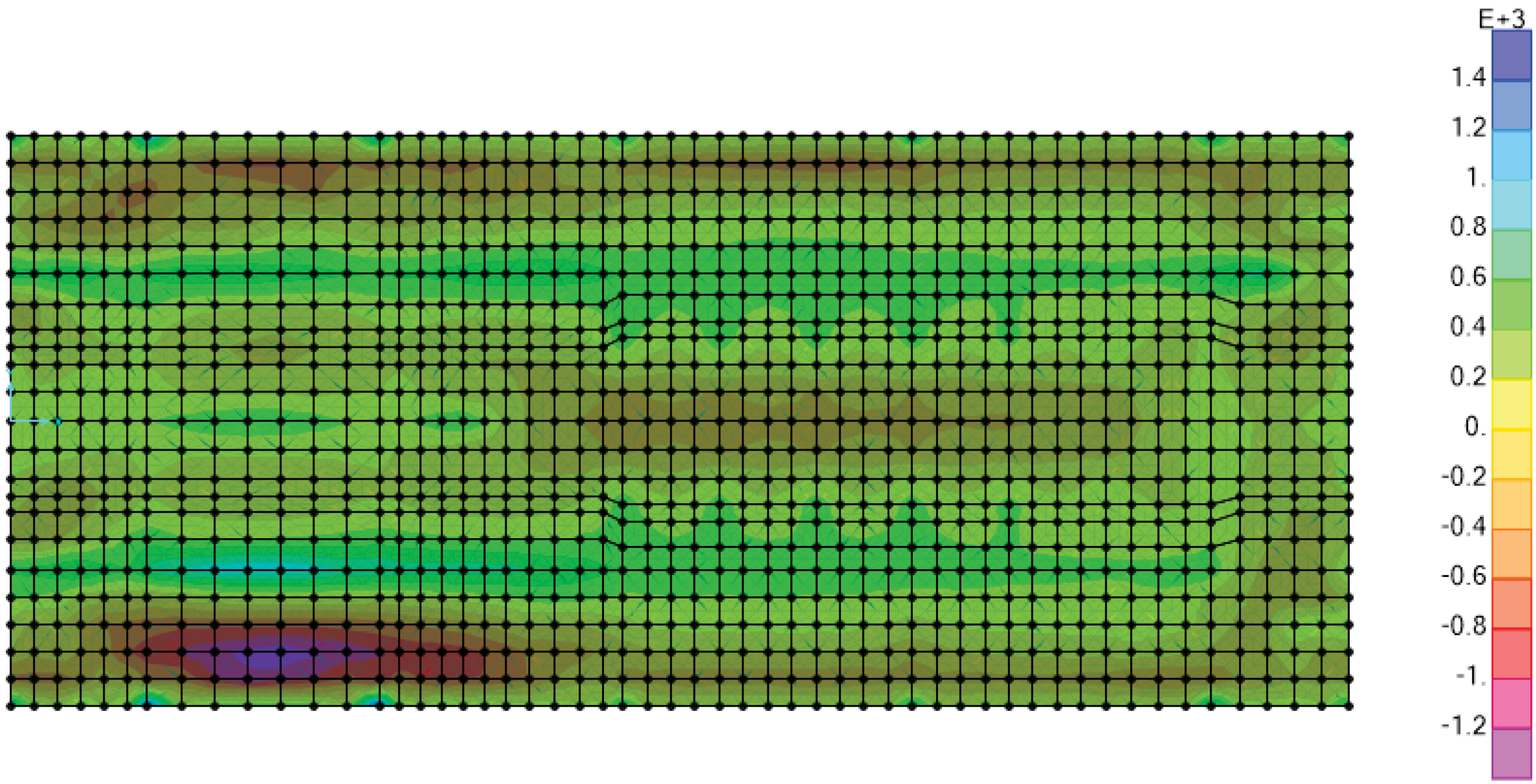
RAI 03.08.05-22S1, RAI 03.08.05-22S2

Figure 3.8.5-5a: Mxx Due to Static Loads on Control Building Basemat, Stand-Alone SAP2000 Model (kip-ft/ft) (Positive X Axis is to the Right of the Image and Positive Y is to the Top of the Image)



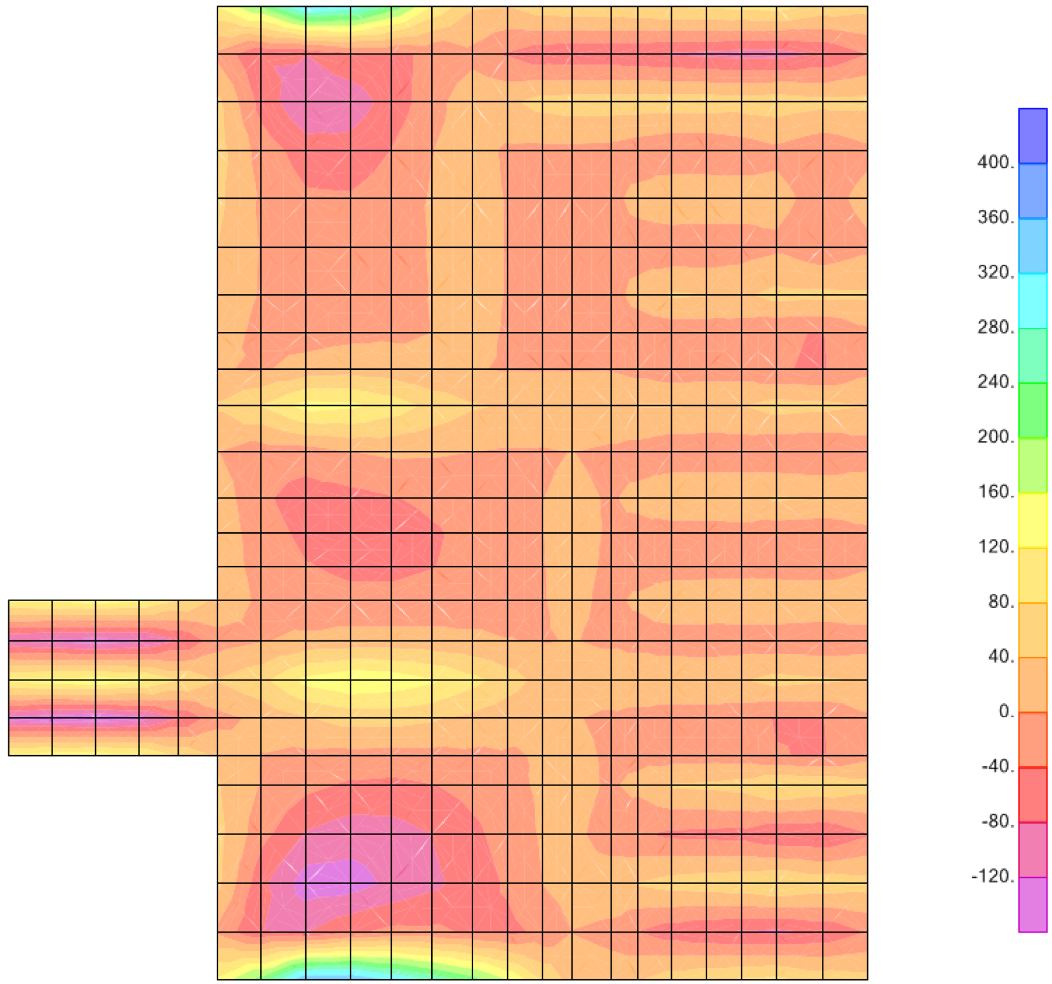
RAI 03.08.05-11S1, RAI 03.08.05-22S1, RAI 03.08.05-22S2

Figure 3.8.5-6: ~~M22 due to Seismic Base Pressure~~Myy Due to Seismic Base Pressure on Reactor Building Basemat (kip-ft/ft) in the Reactor Building Basemat Model (Positive X Axis is to the Right of the Image and Positive Y is to the Top of the Image)



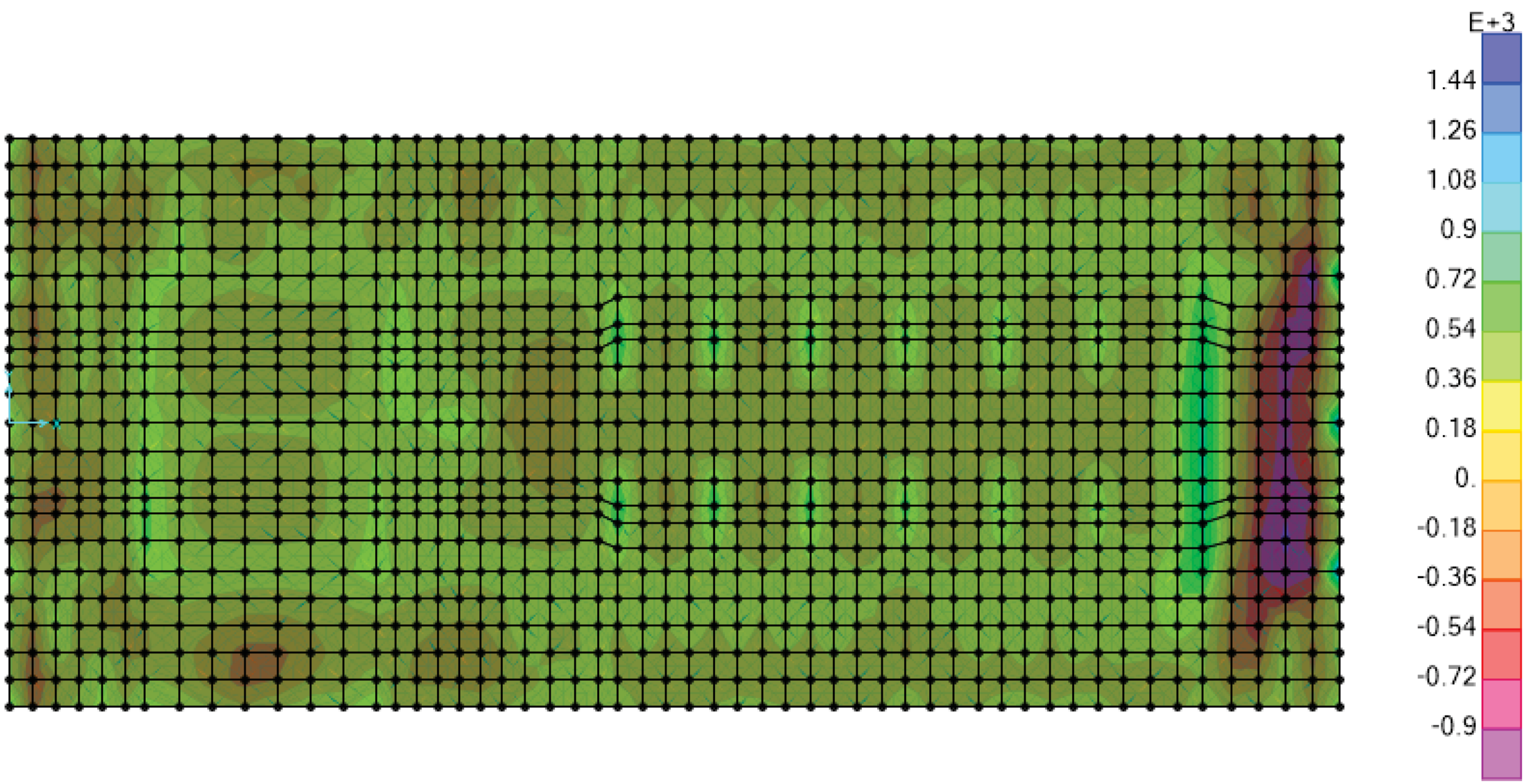
RAI 03.08.05-22S1, RAI 03.08.05-22S2

Figure 3.8.5-6a: Myy Due to Seismic Base Pressure on Control Building Basemat (kip-ft/ft) (Positive X Axis is to the Right of the Image and Positive Y is to the Top of the Image)



RAI 03.08.05-11S1, RAI 03.08.05-22S1, RAI 03.08.05-22S2

Figure 3.8.5-7: ~~M11 due to Seismic Base Pressure~~Mxx Due to Seismic Base Pressure on Reactor Building Basemat (kip-ft/ft) in the Reactor Building Basemat Model (Positive X Axis is to the Right of the Image and Positive Y is to the Top of the Image)



RAI 03.08.05-22S1, RAI 03.08.05-22S2

Figure 3.8.5-7a: Mxx Due to Seismic Base Pressure on Control Building Basemat (kip-ft/ft) (Positive X Axis is to the Right of the Image and Positive Y is to the Top of the Image)